



## Army Access Control Points Standard Definitive Design Guide Active Vehicle Barrier Location Calculation Summary



### Executive Summary

Installation Name  
Assessment Date

Fort Carson  
8/11/2005

Access control point assessments were conducted at each ACP using the procedure described in Appendix D of the *Army Access Control Points Standard Definitive Design*, December 2004. Based on those procedures the following parameters were identified:

$D_{az}$  (Approach zone length)  
 $D_{ai}$  (Distance from the end of the approach zone to the guard/driver interaction point)  
 $D_{ir}$  (Distance from the guard/driver interaction point to the end of the last rejection point)  
 $D_{acz}$   $D_{ai} + D_{ir}$

Each of the parameters were taken from field measurements or where applicable design concepts.

**Table 1: ACP Approach Zone and Access Control Zone Parameters**

Variable	ACP Name									
	Gate 1	Gate 2	Gate 3	Gate 4	Gate 5	Gate 20	0	0	0	0
<b>Daz</b>	437	718	575	1067	312	1083	0	0	0	0
<b>Dai</b>	68	76	0	160	98	0	0	0	0	0
<b>D<sub>ir</sub></b>	105	150	216	48	97	88	0	0	0	0
<b>Dacz</b>	173	226	216	208	195	153	0	0	0	0

Once the above parameters were determined, the initial velocity for each ACP was calculated.

**Table 2: Initial Velocities**

ACP	V (mph)
<b>Gate 1</b>	70
<b>Gate 2</b>	70
<b>Gate 3</b>	45
<b>Gate 4</b>	70
<b>Gate 5</b>	45
<b>Gate 20</b>	55
<b>N/A</b>	0

Based on the initial velocity for each ACP and the lengths shown in table 1 use two zones of continuous speed detection in the approach zone and use the signs and signals safety scheme in the response zone. Using that configuration place the active vehicle barriers at the following distance from the guard/driver interaction point.

**Table 3: Required Distance**

ACP	Distance (feet)	Controlling threat scenario
<b>Gate 1</b>	728	Scenario 1
<b>Gate 2</b>	728	Scenario 2
<b>Gate 3</b>	728	Scenario 2
<b>Gate 4</b>	728	Scenario 2
<b>Gate 5</b>	728	Scenario 2
<b>Gate 20</b>	728	Scenario 2
<b>N/A</b>	728	Scenario 2



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The following calculation results conform to the Army Access Points Standard Definitive Design, Appendix D: Design Procedure. To evaluate the threat scenarios identified in The Army Standard and OPMG Criteria, the length of the **Approach Zone ( $D_{az}$ )** and the length of the **Access Control Zone ( $D_{acz}$ )** need to be determined. The length of the Access Control Zone can be broken into 2 separate dimensions,  $D_{ai}$  which is the distance from the end of the approach zone to the point where the ID Check guard interacts with drivers and  $D_{ir}$  which is the distance from the ID Check guard driver interaction point to the end of the access control zone

**Table 4: ACP Approach Zone and Access Control Zone Parameters**

Variable	ACP Name									
	Gate 1	Gate 2	Gate 3	Gate 4	Gate 5	Gate 20	0	0	0	0
$D_{az}$	437	718	575	1067	312	1083	0	0	0	0
$D_{ai}$	68	76	0	160	98	0	0	0	0	0
$D_{ir}$	105	150	216	48	97	88	0	0	0	0
$D_{acz}$	173	226	216	208	195	153	0	0	0	0

Also to evaluate the threat scenarios, the initial velocity of a vehicle entering the ACP needs to be calculated. There are two types of approaches to the ACP: curved and straight. A curved approach consists of horizontal road curvature and turns such as where an ACP intersects an adjacent roadway and forms a T intersection. To determine the obtainable speed on the turn or curve without spinning out, Appendix D Section D.3.a.Eq 1 should be used.

$$\text{Eq. 1) } V_m = ((f+s) * g * R)^{0.5}$$

Where:

$V_m$ = Spinout speed  
 $f$ = lateral friction  
 $s$ = superelevation rate  
 $g$ = gravitational constant  
 $R$ = Threat radius, computed using CAD

In addition to the curve formula shown above, the approach may also be straight. To calculate the approach speed of a vehicle approaching straight towards the approach zone, engineering judgment was used to determine the distance before the approach zone to consider. The equation for determining initial velocity on a straight path is Equation A.5.c from Appendix D.

$$D = (V^2 - V_0^2) / (2 * a)$$

Where:

$D$ = Distance to the beginning of the approach zone  
 $V$ = Initial velocity to use for threat scenarios  
 $V_0$ = Velocity prior to consideration point (10 mph above posted speed limit for straight approaches)  
 $a$  Acceleration rate, set at 11.3 ft/sec<sup>2</sup> by the OPMG criteria and the Army Standard

The chart below indicates the initial velocity that was used at each ACP

**Table 5: Initial Velocities**

ACP	V (mph)
Gate 1	70
Gate 2	70
Gate 3	45
Gate 4	70
Gate 5	45
Gate 20	55
N/A	0

After the initial velocity was computed, each threat scenario was evaluated to determine the maximum required response zone length to provide sufficient time for guard reaction, barrier safety schemes and active vehicle barriers to deploy to contain the threat. Below are the threat scenarios and the required delay time (t).

	t (sec)
Threat scenario 1: High speed attack	9
Threat scenario 2: Covert 1	9
Threat scenario 3: Covert 2	9
Threat scenario 4: Disobey rejection	7



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Based on the threat scenario calculations, delay time required and acceleration rate, the charts below show the minimum amount of distance required from the ID check point to the active vehicle barriers.

Table 6: Point over-speed detection only using signs and signals safety scheme

ACP	Required Distance from ID Check	Controlling threat scenario
Gate 1	1528.65	Scenario 2
Gate 2	1753.65	Scenario 2
Gate 3	1582.65	Scenario 2
Gate 4	2023.65	Scenario 2
Gate 5	1438.65	Scenario 2
Gate 20	1942.65	Scenario 2
N/A	925.65	Scenario 2

Table 7: 1 zone of continuous speed detection using signs and signals safety scheme

ACP	Required Distance from ID Check	Controlling threat scenario
Gate 1	926	Scenario 2
Gate 2	926	Scenario 2
Gate 3	926	Scenario 2
Gate 4	926	Scenario 2
Gate 5	926	Scenario 2
Gate 20	926	Scenario 2
N/A	926	Scenario 2

Table 8: 2 zones of continuous speed detection using signs and signals safety scheme

ACP	Required Distance from ID Check	Controlling threat scenario
Gate 1	728	Scenario 1
Gate 2	728	Scenario 2
Gate 3	728	Scenario 2
Gate 4	728	Scenario 2
Gate 5	728	Scenario 2
Gate 20	728	Scenario 2
N/A	728	Scenario 2

Table 9: 2 zones of continuous speed detection using signs and signals safety scheme, curvature in the response zone

ACP	Horizontal Distance from ID check to AVB	Total width perpendicular to ID check travel
Gate 1	105	0
Gate 2	150	0
Gate 3	216	0
Gate 4	48	0
Gate 5	97	0
Gate 20	88	0
N/A	0	0



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For presence detection, the Definitive Design sets the controlling threat scenario at Scenario 2

Table 10: 1 zone of continuous speed detection using presence detection

ACP	Required Distance from ID Check	Controlling threat scenario
Gate 1	402	Scenario 2
Gate 2	402	Scenario 2
Gate 3	402	Scenario 2
Gate 4	402	Scenario 2
Gate 5	402	Scenario 2
Gate 20	402	Scenario 2
N/A	402	Scenario 2

Table 11: 2 zones of continuous speed detection using presence detector

ACP	Required Distance from ID Check	Controlling threat scenario
Gate 1	292	Scenario 2
Gate 2	292	Scenario 2
Gate 3	292	Scenario 2
Gate 4	292	Scenario 2
Gate 5	292	Scenario 2
Gate 20	292	Scenario 2
N/A	292	Scenario 2